

ISSUE 9

# SPOTLIGHT

## Hubble Space Telescope Servicing Mission 4



Hubble precisely measured the age of the universe. It found evidence of dark energy. It brought you images of distant galaxies in the young universe. And now, with the state-of-the-art instruments delivered by Servicing Mission 4 (SM4), the Hubble Space Telescope will look into the universe with new eyes, surpassing even its previous vision.

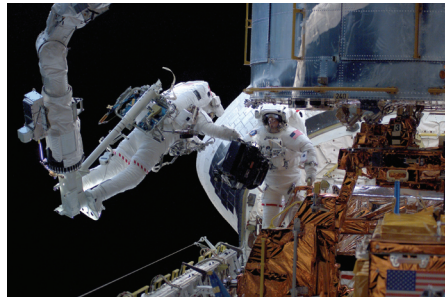
Hubble was designed to be repaired and upgraded by astronauts, and these servicing missions have occurred several times since Hubble's launch in 1990. SM4 has an ambitious program of activities. Over a series of five spacewalks, astronauts will replace worn-out telescope components, and install new batteries, new gyroscopes, a refurbished Fine Guidance Sensor, replacement thermal blankets, and more. It will significantly enhance Hubble's prowess with the installation of two new science instruments: the Wide Field Camera 3 and the Cosmic Origins Spectrograph. These upgrades will keep Hubble functioning at the pinnacle of astronomy well into the next decade.

### Upgrades to Subsystem Components

**Gyroscopes** — Hubble was designed to use three of six onboard gyroscopes to meet its very precise pointing requirements, with the other three held as spares. Gyros have limited lifetimes, and four of the six (all installed in late-1999) are currently working. A fresh set of six new gyros will be installed during SM4 to make the most of Hubble's new science instruments and lifetime peak performance through 2013.

**Battery Modules** — The six batteries currently on board the observatory are all original equipment. The replacement of the two Hubble battery modules (each containing three batteries) will rejuvenate the electrical power system. This, combined with the power system enhancements made in Servicing Mission 3B, will result in ample power margins for the remainder of Hubble's lifetime.

**New Outer Blanket Layer** — Stainless steel sheets will be installed on Hubble's exterior to provide additional thermal protection to some equipment bays, covering the existing multi-layer insulation which has slowly degraded over time with exposure to the harsh environment of space.



### Instruments to be Installed

**Wide Field Camera 3**, or WFC3, will have a broad range of inquiry, from early and distant galaxies beyond Hubble's current reach, to more nearby galaxies with "stories to tell" about their star formation histories, to the planets in our solar system. Along the way, "dark energy" will be seriously probed by WFC3.

**Cosmic Origins Spectrograph**, or COS, will be the most sensitive ultraviolet spectrograph ever flown on Hubble. COS will probe the "cosmic web" - the large-scale structure of the universe whose form is determined by the gravity of dark matter and is traced by galaxies and intergalactic gas. COS will explore how the "cosmic web" evolved from ancient times. COS will also sample the chemical content and physical state of gas in distant galaxy halos, providing important insight into the building process of early galaxies and the production of elements heavier than hydrogen and helium over cosmic time.

**Fine Guidance Sensor**, or FGS, will extend the life of Hubble's "pointing control system," of which three FGS's are a key component. Two FGS's are currently degrading, and the new FGS will replace one of them, making for two completely healthy units—all that's needed for pointing Hubble. The third FGS provides additional target pointing efficiency and redundancy. The FGS's also provide capability for astrometry—the detailed study of stellar dynamics and motions—enabling the detection of close binary stars and star-planet systems.

### Repairs and a Future Rendezvous

#### Space Telescope Imaging Spectrograph

— STIS, the most versatile spectrograph ever to fly on Hubble, ceased operations in August 2004 due to failure of its power supply. STIS is currently in safe mode and not producing science. To restore STIS to operational status, astronauts will attempt an on-orbit replacement of one electronics board inside one of its main electronics boxes.

COS and STIS are highly complementary and would work effectively together to provide a full set of spectroscopic tools for astrophysical research.

**Soft Capture Mechanism** — The SCM is a compact device that, when attached to the Hubble aft bulkhead, will enable and assist in the safe de-orbit of the Hubble Space Telescope at the end of its useful life. This circular mechanism has structures and targets that will allow a de-orbit vehicle more easily to capture and guide the telescope into a safe controlled re-entry.

For more information, contact: Susan Hendrix, Office of Public Affairs 301-286-7745.

Hubble Facts

National Aeronautics and Space Administration





The Hubble Space Telescope

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